Environmental Geomechanics for Cracking in Energy Resources Engineering

Professor Manman HU
（胡曼曼教授）

Department of Civil Engineering
The University of Hong Kong

27 November 2020

11:30 a.m.

Zoom Link: **Here**
Meeting ID: 992 4969 9833
Passcode: 983837

As the demand for energy worldwide keeps increasing, a potential engineering induced damage to the environment causes wide public concerns. New geo-energy technologies (e.g. unconventional shale gas, enhanced geothermal systems) need to incorporate intrinsic mechanisms to prevent negative impact to the environment, strategically inserted into the process from the design to the implementation phase, and hence warrant sustainable usage of energy resources. This type of approach in geomechanics is distinct from the classical one for the fact that it emphasizes the coupling of hydro-mechanical behavior of the geomaterial with the natural and engineered environment – including the temperature, chemical concentrations, mineral dissolution/precipitation, and other physical variables.

Dr. Hu's research group has been focusing on tackling the fundamental multi-scale (in both space and time) multi-physics problems of environmentally assisted crack propagation, with a long-term goal to control the effectiveness of treatment techniques and the extent of chemical footprint. This presentation consists of three parts. First, Mode I (opening mode) subcritical cracking is studied with an emphasis on the effect of the chemical environment. In particular, two constitutive frameworks, namely reactive-chemo-plasticity and reactive-chemo-elasticity, that allow the coupling of chemical mass removal (occurring on the solid-fluid interface at the micro-scale) into the plastic and elastic domain of rock behavior via different mechanisms, are developed and assessed. Subsequently, studies on Mode II (sliding/shear mode) cracking are presented via multi-physics modeling of shear instability and bifurcation through a damage mechanics implementation. Localized shear deformation around a borehole due to internal pressurizing (e.g. by fluid injection) is investigated and the role of temperature is emphasized.

EARTH SYSTEM SCIENCE PROGRAMME

Enquires: 3943 9624 essc@cuhk.edu.hk